L2(5.2) - Translations of a Quadratic Relation

1. factored form: $y = a(x - s)(x - t)$
2. standard form: $y = ax^2 + bx + c$
3. vertex form: $y = a(x - h)^2 + k$

a tells us the direction of opening (up or down), and any vertical scaling (stretch or compression)

h is the x-coordinate of the vertex.

k is the y-coordinate of the vertex.

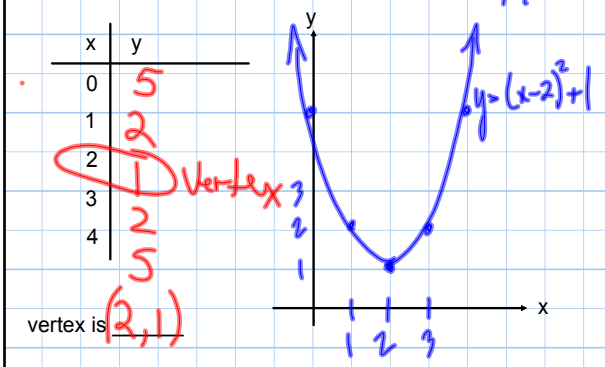
Ex.1 Graph $y = (x - 2)^2 + 1$ using a TOV.

1, 3, 5

x	y
0	5
1	2
2	1
3	2
4	5

Vertex

vertex is (2, 1)



The vertex of the parent function, ☆ $y = x^2$, is (0, 0).

If the vertex has moved from (0, 0) to (h, k) then the graph has been

translated ☆ vertically by k units (up or down)

and ☆ horizontally by h units (left or right)

Vertex Form: $y = a(x - h)^2 + k$

What about the signs of h and k?

h - opposite from equation

k - does not change

Ex.2 State the coordinates of the vertex and direction of opening.

1, 3, 5

(a) $y = (x - 5)^2 + 4$ Vertex (5, 4) Opens Up

(b) $y = (x + 3)^2 + 11$ Vertex (-3, 11) Opens Up

(c) $y = -2(x - 6)^2 - 8$ Vertex (6, -8) Opens Down

(d) $y = \frac{3}{4}(x + 13)^2 - 2$ Vertex (-13, -2) Opens Up

(e) $y = -(x - 4)^2 + 5$ Vertex (4, 5) Opens Down .

Ex. 3. Identify the transformations (in the correct order), the vertex, axis of symmetry, and the direction of opening.

a) $y = (x - 2)^2 - 3$

Transformations (translation)

① horizontal shift right by 2 units

② Vertical shift down by 3 units

Vertex: (2, -3)

AOS: $x = 2$

Def Opening: Up

Optimal value: -3

b) $y = 2(x + 4)^2$

① Vertical stretch by a factor of 2

② Horizontal shift left by 4

Vertex: (-4, 0)

AOS: $x = -4$

optimal value: 0

Def Opening: Up

c) $y = -0.5x^2 + 4$

$y = -0.5(x-0)^2 + 4$

transformations

① reflection in the x-axis

② Vertical compress by a factor of 0.5

③ Vertical shift up by 4 units

Vertex: (0, 4)

AOS: $x = 0$

optimal value: 4

Def opening: Down.

Assigned Work:

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